

REMARKS

In response to the outstanding Office Action dated February 2, 2010, applicant has carefully studied the references cited by the Examiner and the Examiner's comments relative thereto.

Claims 1-3, 6, 7, and 11, the only claims remaining in the application, have been amended, either directly or indirectly, to more clearly define applicant's invention and distinguish the same from the prior art of record.

Claims 4, 5, and 8-10 have been cancelled.

No new matter has been added to the application.

Applicant acknowledges with sincere appreciation, the courtesy of the Examiner in granting a telephone interview with applicant's representative on March 9, 2010. During the interview, the Examiner suggested "to further define the connection between the means for producing a magnetic field and the blank of sheet metal and additionally maintain the structure of the placement of the means for producing a magnetic field".

The flow of metal during deep drawing of the metal is an important element. Controlling the flow of metal during the forming of an article will result in avoiding the tearing of metal, as well as avoiding the formation of wrinkles in the metal, and reduce the amount of trim.

Applicant's invention enables discrete control of the flow of metal during deep drawing. The result is obtained by controlling the flow of metal in critical areas during deep drawing. For example, by controlling the strength of the magnetic field, the restraining forces can be adjusted to allow the desired flow of metal in selected portions of the blank to minimize forming undesired fractures and wrinkles in the blank.

Prior art systems for restraining blanks during deep drawing typically include clamps to grip the edge portion of the blank, wherein the edge portion forms a flange area in the formed article. The flange area is trimmed from the article and disposed as scrap. Applicant's electromagnetic blank restrainer makes it possible to minimize and even eliminate the flange area which minimizes scrap and the need for a trimming operation. Further, the electromagnetic blank restrainer substantially eliminates plastic deformation of the blank in the area being restrained which preserves the ductility of the blank before it flows into the die. The discrete control of the

movement of the blank also allows for fewer dimensional restrictions on tooling such as draw radii, use of thinner blanks to minimize a cost of the article, and reduced draw times.

Applicant's invention produces a magnetic field to exert magnetic restraining forces on a blank of sheet metal to selectively restrain relative movement between the blank of sheet metal and a die during the deformation of the blank of sheet metal. A control system is provided to vary the magnetic restraining forces acting on the blank of sheet metal during deformation of the blank of sheet metal. The magnetic restraining forces can be varied at selected locations of the blank and at selected times during the process of deforming the blank of sheet metal by varying the input of the energizing power to the means for producing the magnetic field. Such discrete control of the restraining forces can be utilized to selectively control relative movement between the first die member and the blank of sheet metal during deformation of the blank of sheet metal.

Rejection Under 35 USC §103(a)

Claims 1-3, 6-8, and 11 were rejected under 35 USC §103(a) as being unpatentable over Thoms et al. (U.S. Patent No. 5,337,520) in view of Hahn et al. (U.S. Pat. No. 5,357,779).

Claim 1 has been amended to recite “means for producing a magnetic field to exert magnetic restraining forces on the blank of sheet metal to selectively restrain relative movement between the blank of sheet metal and the first die member during the deformation of the blank of sheet metal” and “means for controlling the strength of the magnetic field to vary the magnetic restraining forces during the deformation of the blank of sheet metal”.

Thoms et al. discloses that electromagnets can be employed to fix a metal blank on a die member while the die closes. The metal blank is clamped between die members during deep drawing. The clamping force is employed to restrain movement of the blank during deep drawing. Thoms et al. does not disclose the concept of exerting magnetic restraining forces on the blank of sheet metal during the deformation of the blank of sheet metal or the concept varying the magnetic restraining forces during the deformation of the blank of sheet metal as recited in amended Claim 1.

Hahn et al. discloses a redraw carriage 416 adapted to slide on post members 422, 424. (See generally Column 9 Lines 8-29). Redraw magnets 440, 442 are energized and de-energized to cause to and fro movement of the redraw carriage 416, wherein a blank of material 532 can be

clamped between a housing 20 and a redraw sleeve 480 of the redraw carriage 416. (See generally Column 9 Lines 8-15; Column 13 Lines 49-55). The magnets 440, 442 do not exert magnetic restraining forces on a blank of sheet metal. Hahn et al. does not disclose the concept of exerting a magnetic restraining force on a blank of sheet metal during the deformation of the blank of sheet metal or the concept of varying the magnetic restraining forces acting on the blank of sheet metal during the deformation of the blank of sheet metal as recited in amended Claim 1.

The cited references do not show or suggest the concept of exerting magnetic restraining forces on the blank of sheet metal to selectively restrain relative movement between the blank of sheet metal and the first die member during the deformation of the blank of sheet metal. Further, the cited references do not show suggest varying the magnetic restraining forces acting on the blank of sheet metal during the deformation of the blank of sheet metal. Applicant submits that amended Claim 1 is directed to apparatus not shown or suggested in Thoms et al. and Hahn et al., and the Examiner's rejection under 35 USC §103(a) should be withdrawn.

Since Claims 2, 3, 6, and 7 depend, directly or indirectly, from Claim 1, it is submitted that Claims 2, 3, 6, and 7 are directed to allowable subject matter along with Claim 1.

Further, Claim 7 has been amended to recite "wherein the means for controlling the strength of the magnetic field includes a microprocessor for controlling the strength of the magnetic field produced by each of the electromagnets to provide different magnetic restraining forces at selected locations of the blank of sheet metal during the deformation of the blank of sheet metal". Thoms et al. and Hahn et al. both disclose a mechanical clamping force to secure a blank between die members during the deformation of the blank of sheet metal, wherein the clamping force appears to be evenly distributed around a periphery of the blank of sheet metal. Neither Thoms et al. nor Hahn et al., whether considered singly or in combination, shows or suggests different restraining forces at selected locations of the blank of sheet metal to control the movement of the blank during the deformation of the blank of sheet metal as recited in amended Claim 7.

Applicant submits that amended Claim 7 is patentable over Thoms et al. in view of Hahn et al., and the Examiner's rejection under 35 USC §103(a) should be withdrawn.

Since Claim 11 has been amended to include the limitation “to exert a magnetic restraining force on the blank of sheet metal for selectively restraining relative movement between the blank of sheet metal and the first die member” it is submitted that Claim 11 is allowable along with Claim 1.

It is noted that in accordance with the Examiner’s suggestion to “maintain the structure of the placement of the means for producing a magnetic field”, dependent Claim 6 and independent Claim 11 recite that the means for producing a magnetic field (the electromagnets) are disposed “in spaced relation about the open end of the cavity” and “about the cavity in the first die member”, respectively.

The claims remaining in the application properly define applicant’s invention and distinguish it from the prior art of record. Reconsideration of the application, as amended, is respectfully requested. A formal Notice of Allowance is solicited.

While the applicant’s attorney has made a sincere effort to properly define applicant’s invention and to distinguish the same from the prior art, should the Examiner deem that other language is preferable, applicant’s attorney requests the courtesy of a telephonic interview.

Respectfully submitted,



Donald R. Fraser
Reg. No. 17,919

Fraser Clemens Martin & Miller LLC
28366 Kensington Lane
Perrysburg, Ohio 43551
(419) 874-1100
(419) 874-1130